DOCUMENT RESUME

ED 091 218 SE 017 797

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|---|---|
| AUTHOR | Bennett, Dean B. |
| TITLE | A Report on Research and Development in Environmental Education. |
| INSTITUTION | Maine Environmental Education Project, Yarmouth.; New Jersey State Council for Environmental Education, Upper Montclair. |
| SPONS AGENCY | Bureau of Elementary and Secondary Education (DHEW/OE), Washington, D.C. |
| PUB DATE | 16 Apr 74 |
| NOTE | 41p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (47th, Chicago, Illinois, April 1974); Marginal legibility on Section A, pp. 10-16 |
| EDRS PRICE | MF-$0.75 HC-$1.85 PLUS POSTAGE |
| DESCRIPTORS | Attitudes; Curriculum; *Curriculum Development; *Environmental Education; *Evaluation; Instruction; Objectives; *Research |
| IDENTIFIERS | Elementary Secondary Education Act Title III; ESEA Title III |

ABSTRACT

The first section of this document contains a report on research conducted to develop a model to evaluate the attitudinal and behavioral goals of K-12 environmental education. The goals of environmental education are specified, the desired skill outcomes are listed, examples of evaluative techniques are given, and an evaluation of a 2-week unit on the environment taught to junior high school students is described. The second section of this document covers a project aimed at developing a model curriculum for environmental education. Criteria and assumptions are specified; then details of a conceptual model are provided. (DT)

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# A REPORT ON RESEARCH AND DEVELOPMENT

# in

# ENVIRONMENTAL EDUCATION

from two statewide programs,

The Maine Environmental Education Project, Title III, E.S.E.A.

The New Jersey State Council for Environmental Education

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For Presentation at the

Forty - Seventh Annual Meeting of the

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

April 16, 1974

Chicago, Illinois

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*Both of these organizations are members of the Consortium of Regional Environmental Education Councils sponsored by the American Association for the Advancement of Science's Commission on Science Education.

# A REPORT ON RESEARCH AND DEVELOPMENT
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The Development and Testing of a Model to Evaluate the Behavioral Goals of K-12 Environmental Education. Maine Environmental Education Project, Title III, E.S.E.A.**

This is a report on a portion of the research conducted through a doctoral study by the author to develop a model to evaluate the attitudinal and behavioral goals of K-12 environmental education (The University of Michigan, 1972).

* * *

Within recent years there has been an increased recognition of the need for environmental planning and decision-making responsibility on the part of all citizens. This, coupled with the current emphasis on the reappraisal of American education and on curriculum reform, has given impetus to the establishment of education programs which relate to man and his environment.

## The Goals of Environmental Education

It is clear today that environmental education, as it is called, is directed towards the development of attitudes and behavioral skills in the area of environmental decision-making and problem solving. Accordingly, the Maine Environmental Education Project defines environmental education as a process aimed at producing a citizenry that is knowledgeable concerning the total environment and the role of man, able to participate in activities for maintaining and improving the quality of the environment while meeting human needs, and motivated to do so.

Derived from this goal and definition are the following subgoals:

1. (Affective Subgoal)

   To help individuals acquire strong feelings fundamental to developing a concern for the environment

**See Appendix A for a brief description of the Maine Environmental Education Project.

and a motivation to participate in activities for maintaining and improving the quality of the total environment.

2. (Cognitive Subgoal)

   To help individuals acquire basic understanding of the total natural and man-made environment, their relationship with this environment, and common environmental problems.

3. (Behavioral-Skill Subgoal)

   To help individuals develop the necessary thinking and behavioral skills for the prevention of environmental degradation, the correction of environmental abuses, and the alteration and use of natural resources to enhance the function and quality of the environment to meet ecological including human needs.

## Environmental Education As A Process

Environmental education is viewed as a process in which the student participates in three levels of learning experiences:

1) discovery and inquiry,
2) evaluation and problem identification, and
3) problem solving.

Problem identification and problem solving as used here involve not only the recognition, prevention, and resolution of environmental problems but the activities in which students alter and create components in their environment to enhance its function and quality. Students may either act directly on the environment or communicate a concern to others to encourage their participation.

The environmental education learning process emphasizes first-hand experiences focusing on the total environment of the community and immediate surrounding of the student, for example, the school site or neighborhood. The three phases of the process also include classroom experiences.

This approach to environmental education provides an interdisciplinary means of developing values, attitudes, conceptual understandings, critical thinking and behavioral skills.

The process may be carried out by students participating in studies relating to the components of the total natural and man-made environment and related social, political and economic aspects. Figure One suggests how the environmental education process may relate to the study of a natural component of the environment. Figure Two is an outline for the study of walkways and pathways as examples of a man-made environmental component. It should be stressed that it is not particularly important which of the many environmental components is studied

FIGURE 1

THE PROCESS OF
ENVIRONMENTAL EDUCATION

Natural Environment Example: Trees (plants)

| Discovery - Inquiry | Evaluation - Problem Identification | Problem Solving |
|---|---|---|
| Classroom activities -<br><br>Learn about the characteristics, interrelationships, changes, and uses of trees through lessons, books and publications, resource people, films, and other instructional aids. | Group or independent development of criteria to assess: 1) how well trees meet ecological needs, e.g., hold soil, prevent erosion, provide homes for wildlife, etc., and 2) how well trees meet human needs, e.g., physical needs, shade, etc.; psychological needs, aesthetics, etc.; social needs, gathering places, etc.<br><br>Evaluate how well trees meet these needs in a real or hypothetical situation to identify environmental improvement opportunities. | Select a hypothetical problem, e.g., landscape a small park with trees.<br><br>1. Investigate the problem - needs, kinds of trees, etc.<br>2. Develop alternative solutions plans for different plantings in a variety of locations.<br>3. Choose a solution after considering effects of each.<br>4. Develop plan of action - list steps and items needed.<br>5. Present plan for evaluation by others. |
| On-site activities -<br><br>Investigate the trees on the school site and map and describe the kinds present on the site, their locations, sizes, condition, environmental effects, etc. | Develop evaluative criteria as above and assess extent present trees on the school site meet criteria.<br><br>Identify: 1) existing conditions which need to be corrected - diseased trees, storm damaged trees, etc., 2) conditions which could be enhanced by planting trees, and 3) conditions threatening trees which should be prevented. | Select a tree problem to resolve on the school site; for example, white pine blister rust, etc.<br><br>1. Investigate causes, effects.<br>2. Develop alternative solutions.<br>3. Choose a solution.<br>4. Develop a plan of action.<br>5. Carry out plan.<br>6. Evaluate results. |

FIGURE 2

THE PROCESS OF ENVIRONMENTAL EDUCATION

Man-Made Environment Example:

Walkways and Pathways (transportation-circulation areas)

| Discovery - Inquiry | Evaluation - Problem Identification | Problem Solving |
|---|---|---|
| Classroom activities -<br><br>Learn about the kinds, locations, functions, and characteristics of walkways and pathways through lessons, books and publications, resource people, films, and other instructional aids. | Individual and group development of criteria to assess: 1) effects of walkways and pathways on the natural ecosystem - altering drainage patterns, changing microclimate, removing vegetation, etc., and 2) how well walkways and pathways meet human needs: physical - safety, etc., psychological - aesthetics, etc., and social - bringing people together, etc.<br><br>Evaluate walkways and pathways in a real or hypothetical landscape design plan. | Select a hypothetical problem, e.g., develop a plan for a new pathway.<br>1. Investigate the problem - needs, kinds of pathways, etc.<br>2. Develop alternative solutions - routes, kinds of pathways, etc.<br>3. Choose a solution after considering effects of each.<br>4. Develop plan of carrying out solution.<br>5. Present plan for evaluation by others. |
| On-site activities -<br><br>Investigate walkways and pathways on the school site or in the community. Map and describe the kinds, locations, characteristics, conditions, and human and environmental effects. | Apply evaluative criteria as suggested above to walkways and pathways being assessed on site.<br><br>Identify: 1) existing conditions which need to be corrected - erosion, potholes, rerouting, etc., 2) conditions which should be prevented - footwear erosion from overuse, encroachment of vegetation, etc., and 3) conditions which could be enhanced by creating new pathways, signs, etc. | Select a walkway or pathway problem to help resolve on the school site or in the community.<br>1. Investigate causes and effects.<br>2. Develop alternative solutions.<br>3. Choose a solution.<br>4. Develop a plan of action.<br>5. Carry out plan.<br>6. Evaluate results. |

nor that all the components be studied. Rather, it is the process and associated cognitive, affective and skill outcomes which should be emphasized and which will carry over with the student.

## SKILL OUTCOMES

The outcomes of environmental education may be stated as behavioral objectives which reflect the three phases of the learning process described earlier.

1. DISCOVERY AND INQUIRY

   The student will be able to and will continually seek to discover and investigate the components and characteristics of his total environment and the relationship of man with this environment.

   This includes the following skills:

   a. Recognizing the structure, components and processes in natural and human ecosystems.

   b. Investigating the components and processes.

2. EVALUATION AND PROBLEM IDENTIFICATION

   The student will be able to and will continually develop and apply criteria to evaluate the data related to his total environment and associated human processes and to identify opportunities for maintaining and improving his environment.

   This includes the following skills:

   a. Developing criteria and evaluating how well ecological - human needs are being or are likely to be satisfied by environmental components and processes.

   b. Identifying opportunities for environmental maintenance and improvement.

3. PROBLEM-SOLVING

   The student will be able to and will continually participate in selecting and successfully carrying out environmental problem-solving activities involving the prevention and resolution of environmental problems and the alteration or creation of components to enhance the function and quality of the environment.

This includes the following skills:

a. Selecting and defining an issue or problem.

b. Inquiring to become informed about the problem through investigation.

c. Determining alternative solutions to the problem.

d. Evaluating the consequences of solutions and choosing a solution.

e. Developing a plan of action.

f. Implementing the plan of action.

g. Evaluating the process and results.

Each of the above three behavioral outcomes represent skills which may be developed through the "process" learning experiences.

In addition, since a person's behavior is influenced by how he feels and what he knows, related affective (feelings) and cognitive (knowledge) outcomes should also be identified. This report, however, will focus on the skill outcomes.

## DEVELOPMENT OF A BEHAVIORAL OBJECTIVE MODEL

On the following pages the skill outcomes previously identified have been re-written and described as basic observable and measurable behaviors. These behavioral statements or objectives describe what the student should do, to what extent and under what conditions to indicate that each outcome sought has been achieved. In addition, the desired skills are written to relate to each of the three environmental education experiences

1) discovery - inquiry

2) evaluation and problem identification, and

3) problem - solving.

As a whole, the basic behavioral objectives provide a model from which test items may be developed. Using the basic behavioral objectives for skills as a guide the teacher can develop courses, units, independent studies, presentations, field trips and any number of educational experiences to achieve the identified outcomes. In designing these learning experiences, the teacher might first choose those skills, feelings and concepts he or

she wishes to develop. For each of these a basic behavioral objective is suggested. Using these as a guide, the teacher may then write behavioral objectives which describe what the student will do while participating in the unit, presentation, field trip, etc. These are called process or learning activity objectives since they occur while the students are in the process of being involved in the learning experience. Actually, they describe what the teacher should liik for during class activities which indicates that students are progressing satisfactorily.

A second kind of behavioral objective can also be developed from each basic behavioral statement. This behavioral objective is used to guide the formal testing of the skills both before and after the learning experience. In this kind of evaluation students might be asked to take a pencil-and-paper test. Such a test is particularly suited for evaluating skills and knowledge.

A third kind of behavioral statement can be developed from the basic behavioral objective. This is one especially related to evaluating feelings. It is called an unobtrusive evaluation technique because the student is not aware that he is being tested. It is an advantage for the evaluator when determining the presence of certain feelings that the student is not biased by the knowledge that he is being observed by the teacher.

On the next few pages examples of these evaluative techniques are given. These examples relate to behavioral objectives developed for a junior high school unit on the school environment (see Appendix B for description of the unit). Two unit behavioral objectives, i.e., learning activity and pencil-and-paper, in turn have been drawn from the basic behavioral objectives. These describe what a student should do to indicate that he possesses the skills.

# SKILL BEHAVIORAL OBJECTIVES AND OBJECTIVES-BASED SAMPLE TEST ITEMS

## DISCOVERY - INQUIRY SKILLS

(Written to be developed through discovery - inquiry learning experiences)

### 1. SKILL IN RECOGNIZING AND SELECTING TOPICS TO INVESTIGATE

Basic Behavioral Objective: The student will more completely identify and select topics for study related to all the major components of the natural and man-made environment.

Example: Related Process or Learning Activity Behavioral Objective (what the student will do during the learning experience)

The student will identify the major components and related topics of the total natural and man-made environment of the school site and select one for study.

Example: Related Formal Evaluation Behavioral Objective

The student will, while observing a series of slides of a school site, complete a list of broad environmental topics and components which should be investigated to gain an understanding of the total natural and man-made environment.

Sample Test Item:

Assume that you wish to improve the environment of your school site. First, you decide to learn as much about the total surroundings of your school as you can. This will help you to discover improvement opportunities you can work on.

What are the major natural things in our environment?

As you view the slide, check the list below carefully to see if it includes all the major natural parts of our total environment. If you feel the list is complete, check the space at the top. If incomplete, add to the list.

Major Natural Parts

The list below is complete _____

Land (soils, rocks, minerals, etc.)
Energy (sunlight)
Plants
Animals

If list is incomplete, add here:_____
_____
_____

2. SKILL IN CARRYING OUT AN INVESTIGATION

Basic Behavioral Objective: The student will develop more complete plans and draw upon an increasing number of different sources of relevant and accurate information in his investigation of the components and characteristics of his total environment and man's role in meeting ecological and human needs.

Example: Related Process or Learning Activity Behavioral Objective

The student will plan the objectives and steps of his investigation and identify and utilize a number of sources of information including first-hand study on-site.

Example: Related Formal Evaluation Behavioral Objective

The student will, while observing a slide of a component of a school site select the most important kinds of information to gather and arrange a series of investigative steps in a logical order to carry out the gathering and compiling of information.

Sample Test Items:

You have been asked to gather information on the school site which will help identify improvements for the movement of people and vehicles. Included are facilities for walkways, streets and drives and parking areas as shown in the slide.

a. Listed below are some of the different kinds of information you should gather to help you in finding improvements which could be made for the movement of people and vehicles on the site.

Check the five most important kinds of information you would need.

_____ Who maintains the facilities?

_____ How long have the facilities been in existence?

_____ What kinds of facilities exist?

_____ What is the condition of the facilities?

_____ Where are the facilities located?

_____ What are the effects of the facilities on people and nature?

_____ How are the facilities maintained?

_____ What are the future needs for movement of people and vehicles on the site?

b. Number the steps below in the way you would go about investigating the traffic and pedestrian facilities on the school site.

_____ Complete a detailed map of the site's transportation and circulation facilities upon which to show problem areas.

_____ Prepare a written report on your findings.

_____ Interview the school maintenance department personnel to determine how well the facilities are meeting needs and record areas where improvements could be made.

_____ Study and observe the facilities in operation to confirm problems and discover new areas of improvement.

_____ Take a walk around the site to find out, sketch and note the kinds, sizes and locations of existing facilities.

3. SKILL IN COMPILING INFORMATION

Basic Behavioral Objective: The student will, with an increasing degree of skill, accuracy, and completeness compile and organize collected information in both written and graphic (maps, graphs, etc.) form.

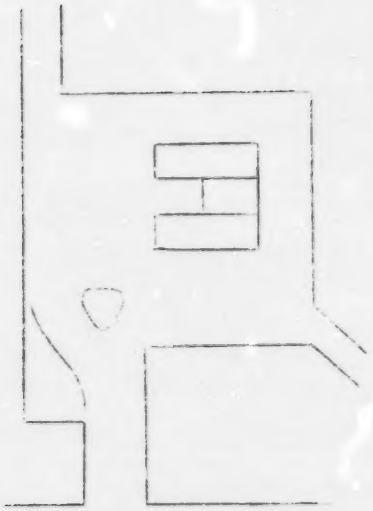
Example: Related Learning Activity Behavioral Objective

The student will completely and accurately compile information in both written and graphic form.

Example: Related Formal Evaluation Behavioral Objective

The student will, while observing a series of slides of a school site, correct and complete a map of the site showing the location, shape, and relative size of major components.

Sample Test Item:



Here is a sketch map of your school. Locate your classroom with an X. Change any of the features which are not located properly if this is needed. Add and locate the school flagpole on the map.

EVALUATION - PROBLEM IDENTIFICATION SKILLS

(Written to be developed through evaluation-problem identification learning experiences)

## 4. SKILL IN DEVELOPING EVALUATIVE CRITERIA

Basic Behavioral Objective: The student will increase in his ability to develop meaningful criteria based upon fundamental natural and human needs and processes for the purpose of seeking meaning from collected data.

Example: Related Learning Activity Behavioral Objective

The student will develop criteria based upon natural and human needs and processes for the purpose of judging the degree to which selected natural and man-made components meet the identified needs.

Example: Related Formal Evaluation Behavioral Objective

The student will, while observing a slide showing an unstable and more stable natural environments, select accurate definitions of natural ecosystem stability.

### Sample Test Items:

A healthy and lasting natural environment is one which: (Circle four statements which are more likely to describe a stable environment.)

1) contains many different kinds of plants with balanced numbers

2) contains only a few kinds of plants but each kind in large number

3) has much matter (plant nutrients) available

4) has little matter (plant nutrients) because it has been used

5) a small amount of the sun's energy is being used by plants and animals

6) a large amount of sunlight is being used but it is not being recycled

7) matter (nutrients) is being recycled and re-used

5. SKILL IN EVALUATING THE ENVIRONMENT AND IDENTIFYING OPPORTUNITIES FOR MAINTAINING AND IMPROVING THE ENVIRONMENT

Basic Behavioral Objective: The student will evaluate data against criteria and identify and define existing and potential environmental issues and problems in increasing number and complexity.

Example: Related Learning Activity Behavioral Objective

The student will evaluate collected data against criteria and identify and define opportunities to help prevent environmental abuses, correct existing detrimental conditions and alter the environment to enhance its function and quality.

Example: Related Formal Evaluation Behavioral Objective

The student will, while observing a series of slides showing selected natural and man-made environmental features, indicate for each feature shown the most important need it doesn't meet by writing its number opposite the appropriate response.

Sample Test Item:

For each of the next five slides, answer the following questions.

To the right is a list of needs which the environment should meet. As you view each environmental feature or condition shown by a slide, select from the list at the right the most important need not being met. Place the number of the need in the blank space after the letter of the slide.

| Need Which is NOT Being Met | Needs Which the Environment Should Meet |
|---|---|
| SLIDE A _____ | 1. A variety of healthy trees and plants |
| SLIDE B _____ | 2. Matter (soil nutrients) available and not being lost |
| SLIDE C _____ | 3. Man-made things are convenient and efficient to use |
| SLIDE D _____ | 4. Man-made things are safe and healthy |
| SLIDE E _____ | 5. Parts of the environment are pleasing - enjoyable to look at |

PROBLEM - SOLVING SKILLS

(Written to be developed through problem-solving learning experiences)

6. SKILL IN PROBLEM-SOLVING

Basic Behavioral Objective: The student will increase in his ability to select and define issues and problems and efficiently, completely and successfully think through and help carry out the environmental problem-solving processes with selected issues and problems:

a. Investigate the issue or problem to become informed.

b. Determine alternative solutions and their consequences.

c. Evaluate the consequences of solutions and choose appropriate ones.

d. Develop a plan of action.

e. Implement the plan of action.

f. Evaluate the process and results.

(Included in the above are skills related to critical thinking, change strategy and political efficacy.)

Example: Related Learning Activity Behavioral Objective

The student will successfully participate in the process of selecting, planning, and carrying out an environmental problem-solving activity.

Example: Related Formal Evaluation Behavioral Objective

The student will, given a series of slides and descriptive information related to environmental problems:

a. define central issues,

b. correct, complete, and logically arrange a list of problem-solving steps,

c. identify most likely sources of information,

d. select the best alternative solutions from several possibilities described,

e. select the most logical rationale for the alternative solution chosen,

f. choose a logical plan of action from several described, and

g. choose the best evaluation procedure from several described.

Sample Test Items:

1. This is a marker along a nature trail which was built near a school to give both students and visitors an opportunity to walk around the site and enjoy it as well as to learn about it. The marker locates and describes for the visitor a special area where certain kinds of wildlife may live.

Imagine you are going to help a class build a nature trail on the school site as these students are doing. Below is a listing of some of the important things to be done.

Number these in the order which you think they should be carried out numbering your first step as one (1).

_____ Make a map of the locations of different things found on the site.

_____ Study how the trail is being used and what people think about it so that if changes are needed they can be made.

_____ Investigate the area which will be used for a nature trail. Find out, study, and describe what is there.

_____ Choose the one best route to take after considering the problems which might occur with each one planned.

_____ Make a plan of how the trail will be built; who will do what, when to do it, what is needed for equipment, etc.

_____ Draw several different routes the trail might take so the visitor will have an enjoyable and educational experience.

2. Here is a stunted and diseased tree on the parking area and playground of a school. The tree is the only one near the school, it provides shade, attracts wildlife, and the students have a great deal of fun playing on it. Some say the tree should be removed because it is obviously sick and dying, falling dead limbs could be a hazard - "a sick tree is a dangerous tree," it takes time to plow around it in winter, and it is in the way for needed parking during most of the year. Others say it is not dying and it's health can be restored by breaking away the tar from around its base so it can get more air and water, its dead limbs can be cut off, a new parking area should be found, and the tree should be left on the site.

Check the statement below which you believe to be correct.

_____ The main issue here is finding a parking area.

_____ The main issue here is whether the tree is going to die or not.

_____ The main issue here is whether or not there should be a tree in the school yard.

# RESULTS OF AN EVALUATION

During April and May of 1972, a study was conducted utilizing the methods and techniques outlined in this report. Approximately seventy-five (75) students were involved representing grades six through eight in the Freeport, Maine, Junior High School. The students had elected to take a two-week course in environmental education meeting eighty minutes per day, five days per week. The students were divided into three classes of approximately twenty-five each and scheduled according to school group divisions for three two-week classes covering a time span of six weeks.

Using the basic behavioral objectives presented in this report as a guide, a two-week unit was developed focusing on the environment of the school site (see Appendix B). Unit behavioral objectives and learning activities were planned which would involve the students in classroom and firsthand investigations, evaluation-problem identification and problem solving. These three kinds of learning experiences represented the process of environmental education or independent variable. The unit behavioral objectives, in addition, provided guidelines for observations of the students while engaged in the process.

Following the development of the teaching unit, behavioral objectives were written for the formal pencil-and-paper test. These were also drawn from the basic behavioral objectives. Using the formal evaluation behavioral objectives as a guide, test items were then devised for the pencil-and-paper instrument. Since all behavioral objectives followed Mager's suggestions that they state what the students would be expected to do as well as the extent and under what conditions, the development of test items from the objectives was facilitated. During this part of the design process, slides were selected to accompany the questions. Several hundred were reviewed. The slides served two purposes: (1) for some questions these slides provided a visual image about which students were asked to react and (2) for other questions the slides served merely as stimuli for the students concerning the topic of the question.

Following the development of the first draft of the instrument it was pretested with twenty-five students participating in the first two-week unit. Also during the two-week time period the unit was refined.

Upon completion of the pretest of the formal instrument's first draft, the test was evaluated and revised to increase its validity, sensitivity, and time appropriateness.

Prior to the administration of the final version of the instrument, the names of students participating in the experimental group were procured. This group was the second class of twenty-five students receiving the unit during the middle two weeks of the six-week time span. Each student in the experimental group was then assigned a number from one to twenty-five. Using a list of random numbers, thirteen students were randomly selected to receive the formal pretest. All were to receive the formal post-test.

At the same time, the names of students who were to receive the unit during the last two weeks were procured. These students became the control group during the middle two-week period. As with the experimental group, thirteen students were randomly selected to receive the formal pretest. This group was to receive the pretest at the same time as the experimental group. All students of the control group were to receive the formal post-test.

All pretests were administered during the first class session of the unit. The post-tests were administered during the last session with the exception of the control group. For this group the post-test was administered following a weekend three days later during their first class session. This was convenient in that no special scheduling was required.

Following the administration of the formal test instrument, data were tabulated for pre and post-test results.

Both descriptive and inductive statistical analyses were used. The inductive statistical analysis consisted of a series of five t-tests run on the nine sub-tests of the instrument. These tests were two-tailed and run at the .05 ALPHA level. The tests sought to answer the following research questions:

1. Were experimental and control groups equal at the beginning of the two-week experiment on the nine areas of the instrument?

2. After two weeks in the program, did the Experimental Pre-Post-test Group score higher on the post-test than on the pretest in any of the nine areas?

3. After two weeks in the program, was the gain made by the Experimental Pre-Post-test Group greater than the gain made by the Control Pre-Post-test Group in any of the nine areas?

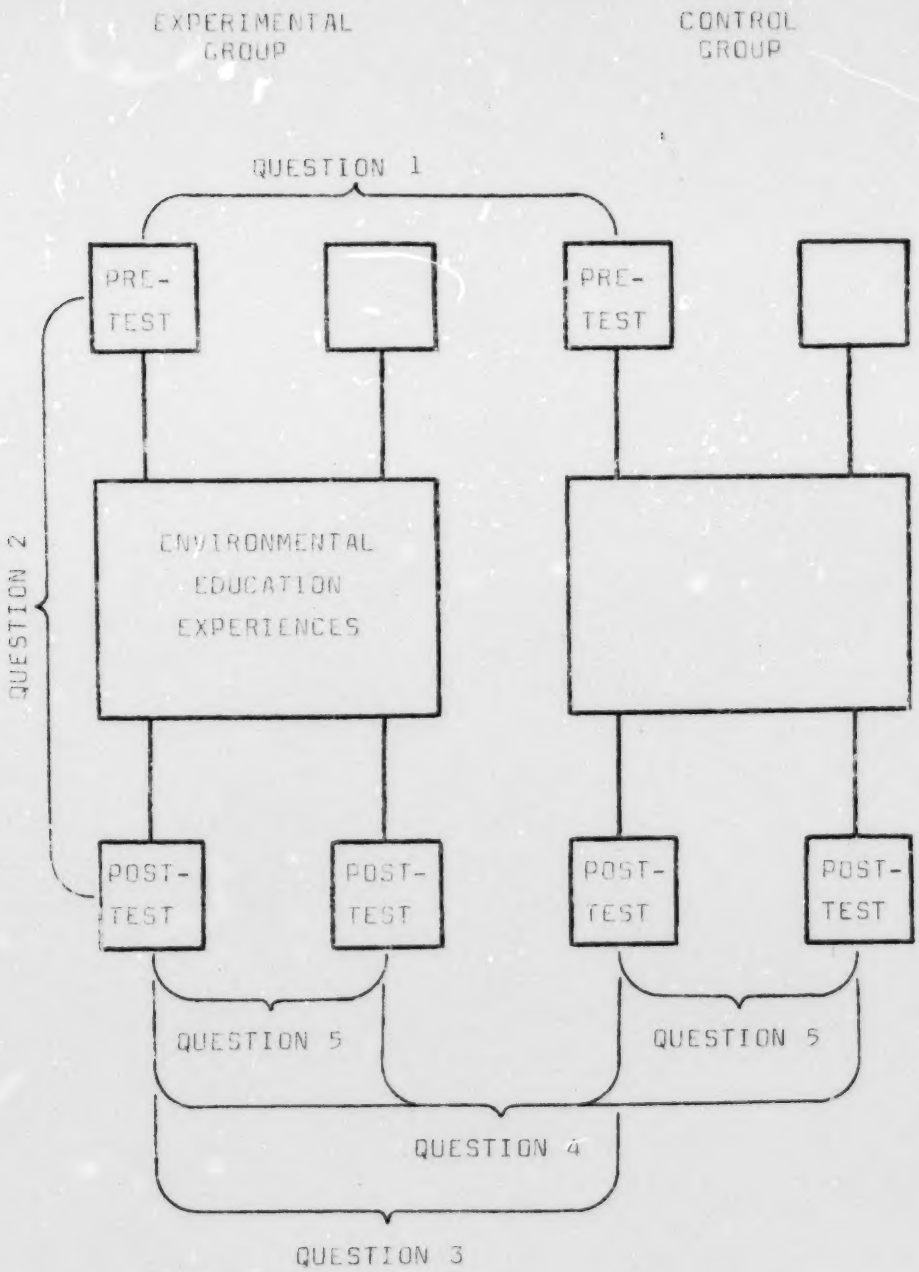
4. After two weeks in the program, were the post-test results of the combined experimental groups (Pre-Post-test Experimental Group and Post-test Experimental Group) greater than the post-test results of the combined control groups (Pre-Post-test Control Group and Post-test Control Group) in any of the nine areas?

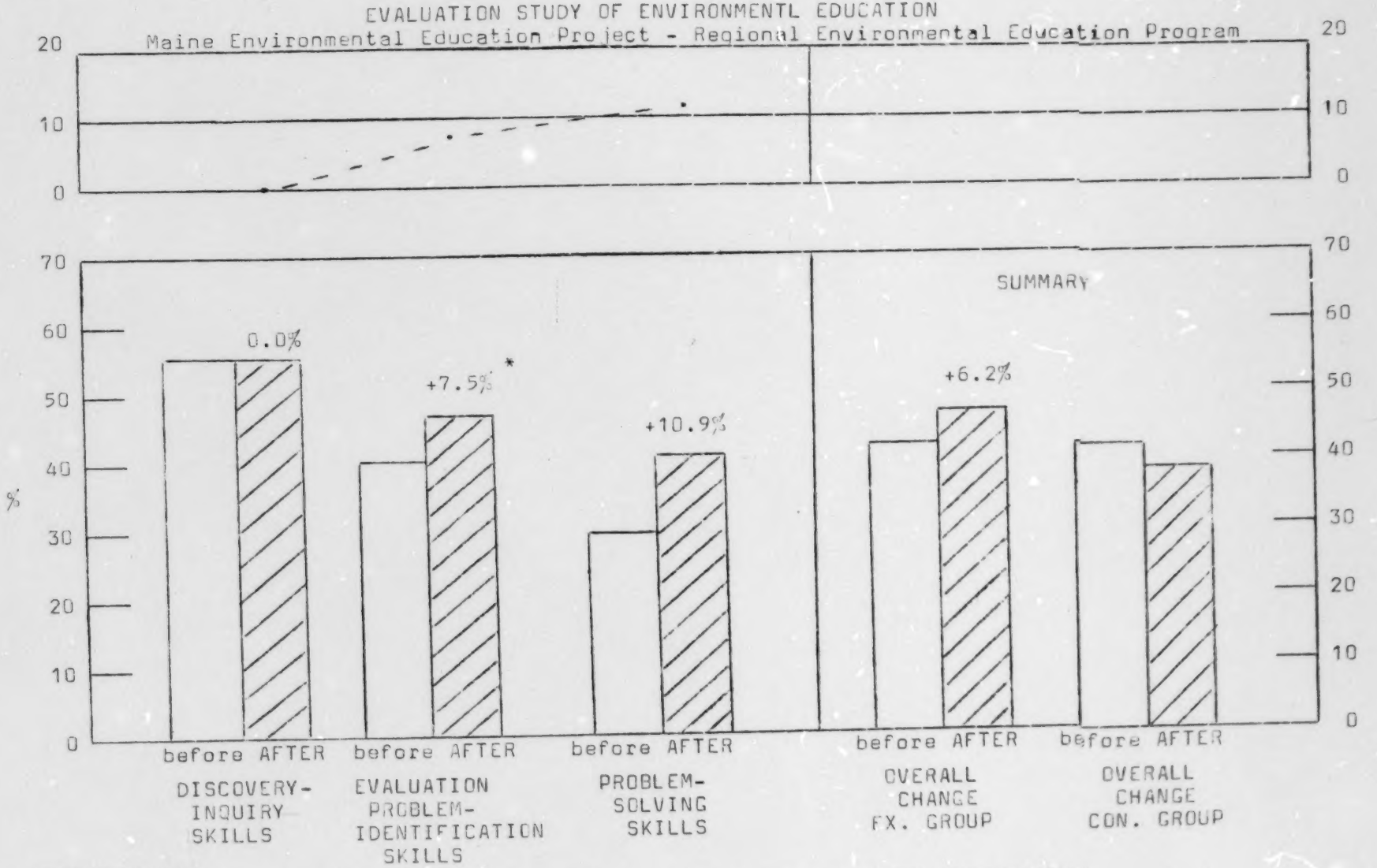
5. Did taking a pretest affect results on a post-test taken two weeks later in any of the nine areas?

Figure 1 is a diagram of the relationship of the questions to the research design.

One set of results is of particular interest. Within the variable Ability to Act on an Ecological Value System are three sub-variables. The first of these, Discovery - Inquiry, showed no descriptive change between pre and post-tests of the Experimental Group. The second, Evaluation - Problem Identification, revealed a 7.5 mean percent increase while the third, Problem Solving, showed a 10.9 mean percent increase. An interpretation of this might be based on the fact that the first sub-variable is related strongly to traditional methods of education whereas the latter two represent areas to which students are not normally exposed. Therefore, one might expect greater learning to occur with respect to them. See Figure 2.

Figure 1. Relationships of research questions to research design






*STATISTICALLY SIGNIFICANT .05 LEVEL

ABILITY TO HELP MAINTAIN AND IMPROVE A QUALITY ENVIRONMENT
EFFECT OF ENVIRONMENTAL EDUCATION LEARNING EXPERIENCES
Two-Week Unit Focused on the School Site Environment - 80 Min. per Day
Freeport Junior High School

FIGURE 2

The Development of Environmental Education Curriculum Guidelines for New Jersey. The New Jersey State Council for Environmental Education.

This is a report on a research project carried out by the New Jersey State Council for Environmental Education to develop a curriculum plan for reaching the goal of developing an environmentally literate citizenry. As a result of this project, the Council has produced a computer based K-12 environmental education curriculum. This program will be the subject of an evaluation research program during the coming year to test its effects on students and teacners. Following are excerpts reproduced from the Curriculum Guidelines: A Working Paper published by the Council on Jan. 12, 1972.

* * *

## CRITERIA AND ASSUMPTIONS

Criteria and assumptions have been made explicit when recognized and identified. These serve to provide a consistent basis for dealing with curriculum construction. They become a working part of a rationale that explains choices and decisions to be made in developing this curriculum. The reader has a better understanding and basis for critical review of that which is accomplished. Hopefully, these will enable continued future improvement by making process, as well as product, available for analysis and refinement.

Some of the criteria flowed from the nature of the project, as approved by State and Federal agencies. Others flowed from the goal of the Council. Still others have been based upon professional knowledge and experience.

For ease of reference, the assumptions and criteria have been listed separately.

A. Assumptions

It has been assumed that:

1. a model environmental education curriculum produced for the State of New Jersey can facilitate local decisions about curriculum development, adoption and implementation;

2. a useful curriculum will receive acceptance by local districts and schools;

3. there is a limited number of variables that can be included because of cost/time factors and the choices made are to reflect consideration of these factors;

4. environmental education is important enough to receive a place in curriculum, in fact is critical to the State citizenry;

5. environmental education will result in an improved environment;

6. environmental education can be financially supported by the educational organization of New Jersey.

B. Criteria

The following criteria have been established:

1. The curriculum must be developed to serve the school population K-12 of New Jersey, in a flexible way to facilitate achievement of local educational goals.

2. Cost to individual users of the curriculum must be kept to a minimum for achieving an environmentally literate citizenry.

3. There must be provision within the curriculum for a diversity of approaches to teaching, learning and environment.

4. There must be provision for inclusion of up-to-date environmental information.

5. The use of the curriculum must require minimum outputs of time, energy and skills on the part of the consumer.

6. The curriculum must contribute to one's knowledge of, concern for and decision-making ability relative to the environment, in particular to that of New Jersey.

7. Individual parts of the curriculum must be capable of being revised, replaced and improved without having to build an entire "new" curriculum.

8. A feedback mechanism must be included as a means to monitor and improve the curriculum.

9. Materials to be included in the curriculum will be chosen on the basis of selected available educational theories and practices.

10. Materials included must contribute to achievement of curriculum objectives.

# DEVELOPMENT OF A CONCEPTUAL MODEL OF CURRICULUM

## INTRODUCTION TO THE MODEL

The New Jersey State Council for Environmental Education, under an E.S.E.A., Title III, section number 306 grant, entitled Implementation of State of New Jersey Master Plan for Environmental Education, has committed itself to the construction of a curriculum for state use in developing environmentally literate citizens. The major thrust of this effort is directed initially to K-12 students.

Since New Jersey does not have a state determined curriculum which prescribes in specific terms what must be embraced. Curriculum is decided at the local level, and much of this decision rests with the teachers and other professional staff. The need to provide a curricular structure that facilitates local decisions is apparent. Individual teachers must be able to have a selection or prescription available in environmental education that is economical of time, effort and money and that has the highest quality choices included.

The nature and size of the target population demands use of the latest technology in order to copy with the many variables at hand. For this reason a decision to utilize a computer based program has been considered, and efforts to determine cost/feasibility factors are simultaneously occurring with development of the curriculum.

Another factor affecting the need for flexibility in curriculum choices is the fluid state of environmental education, and indeed the dynamic state of the environment itself.

Therefore, the following model was designed. The model consists of several parts, to be developed sequentially. These include field, input, and evaluation. Together, these provide the basic framework of the curriculum.

## SECTION A

## PARTS OF THE MODEL

### Part 1 - Field

A close examination and explanation of the various parts of the model begins with that part labelled "field" (Diagram 1). Note that the field is divided into a number of stages, each consisting of a cluster of basic behavioral objectives (Diagram 1, section a). These objectives represent minimal necessary learning behaviors in the areas of knowledge (cognitive domain), decision-making and the affective domain that contribute to the development of environmentally literate citizens. These objectives are to be developed or selected based upon the best knowledge available to the educational profession to date. Experts from various fields, as well as related research and theoretical work on learning, teaching and environmental education will be used to help determine these objectives. In addition evaluation of the program will provide an empirical base for continuing, modifying, adding or eliminating objectives as reality demands.

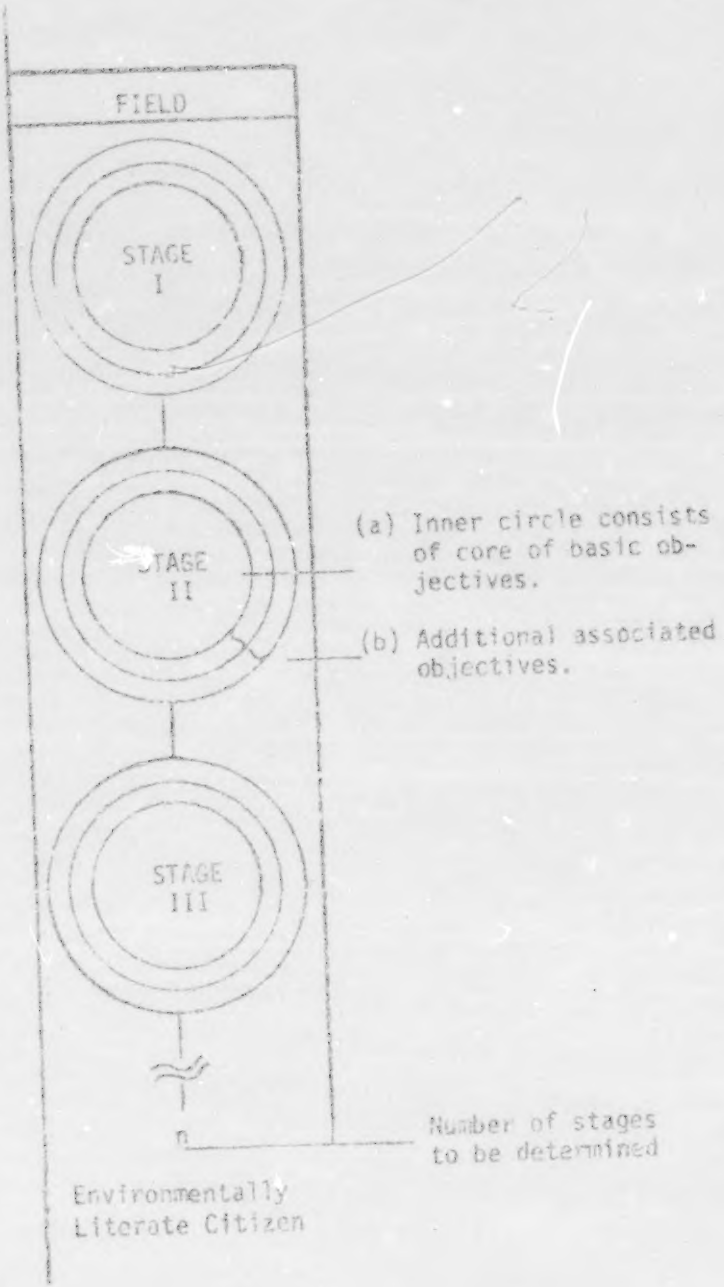
By the nature of the New Jersey State Council for Environmental Education grant, this curriculum is being created initially for a target student population ranging from Kindergarten through grade twelve. Therefore, the final number of selected stages will reflect the characteristics of this population.

Each stage has a core of basic behavioral objectives that, as stated previously, reflect minimal necessary learnings. If the population of New

Jersey is to be able and willing to support a curriculum that achieves these minimal necessary learnings, then they must be capable of being achieved by a minimal output of time, energy and resources. This point is critical throughout the model.

In addition to the core of each stage, there will be associated objectives (Diagram 1, section b) built in that will be related and appropriate for those interested in and capable of supporting a range of learnings that would involve maximum time and resources. Therefore, there will be numerous choices available to the public, based upon their values, attitudes, interests and resources.

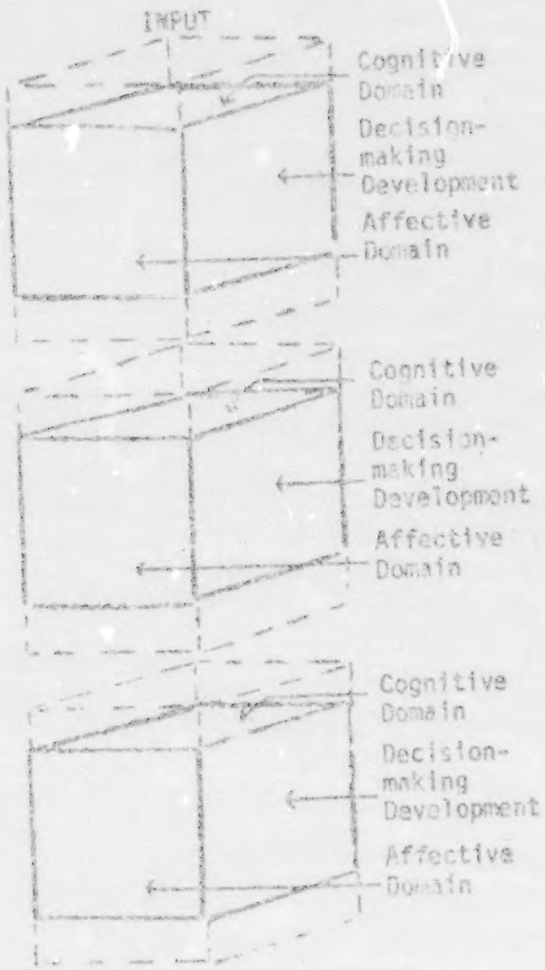
DIAGRAM 2


FIELD
STAGE I
STAGE II
STAGE III
n
(a) Inner circle consists of core of basic objectives.
(b) Additional associated objectives.
Number of stages to be determined
Environmentally Literate Citizen

## Part 2 - Input

The part labelled "input" refers to a systematic programming of available materials from the areas of the affective domain, the cognitive domain restricted to environmental aspects, and decision-making development (Diagram 2). Each piece of this program will be selected for inclusion if it represents the most suitable in its area and is judged capable of contributing to the accomplishment of the objectives.

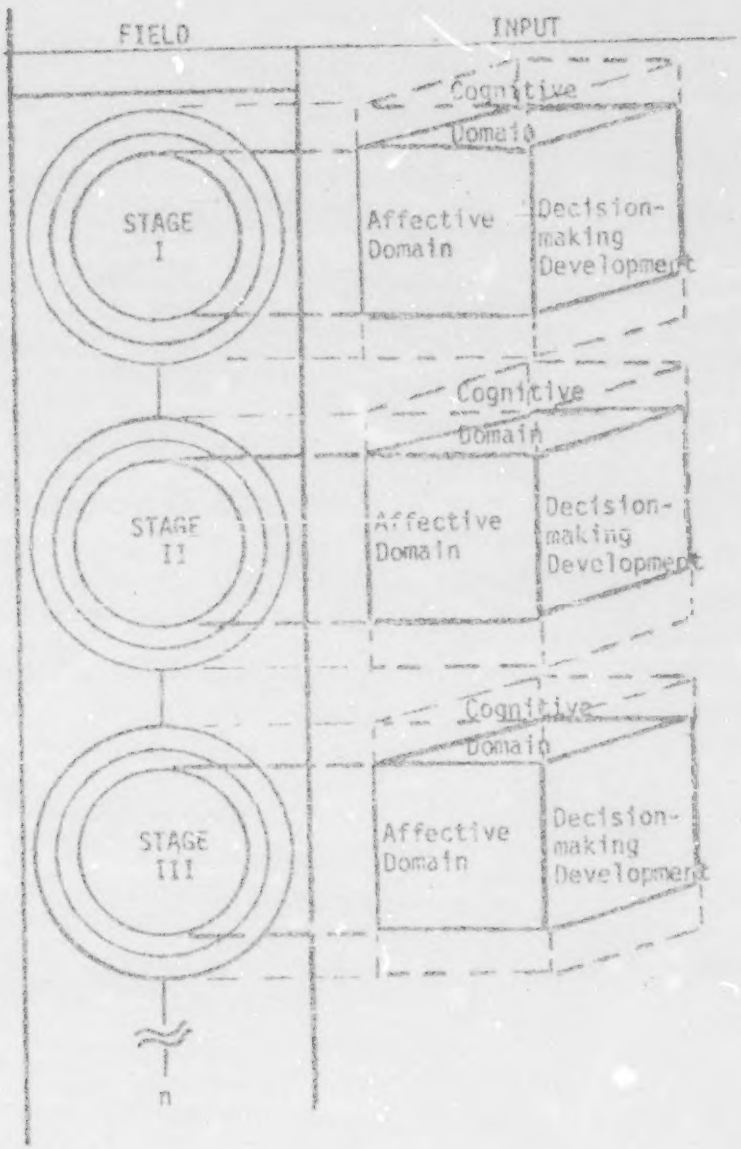
DIAGRAM 2



Relationship of Field to Input

These two areas, field and input, represent objectives and materials which become available for use in developing an environmentally literate citizen (Diagram 3). Materials will be included when these are judged as contributing to the accomplishment of objectives contained in a stage within a field.

DIAGRAM 3



## Part 3 - Evaluation

Evaluation (Diagram 4) initially serves as a diagnostic tool in determining "what is" in relation to any stage. Based upon the findings of pretesting (Diagram 4, section a), as well as local descriptive data provided by the teacher, appropriate materials will be selected for the group from the In-put program (Diagram 4, section b). This may range from simple bibliographic notation for locally available materials to printouts of materials to the lending of certain materials from a state-wide, county or other administrative unit source. Cost and efficiency factors will play an important role in making determination of how these will be made available.

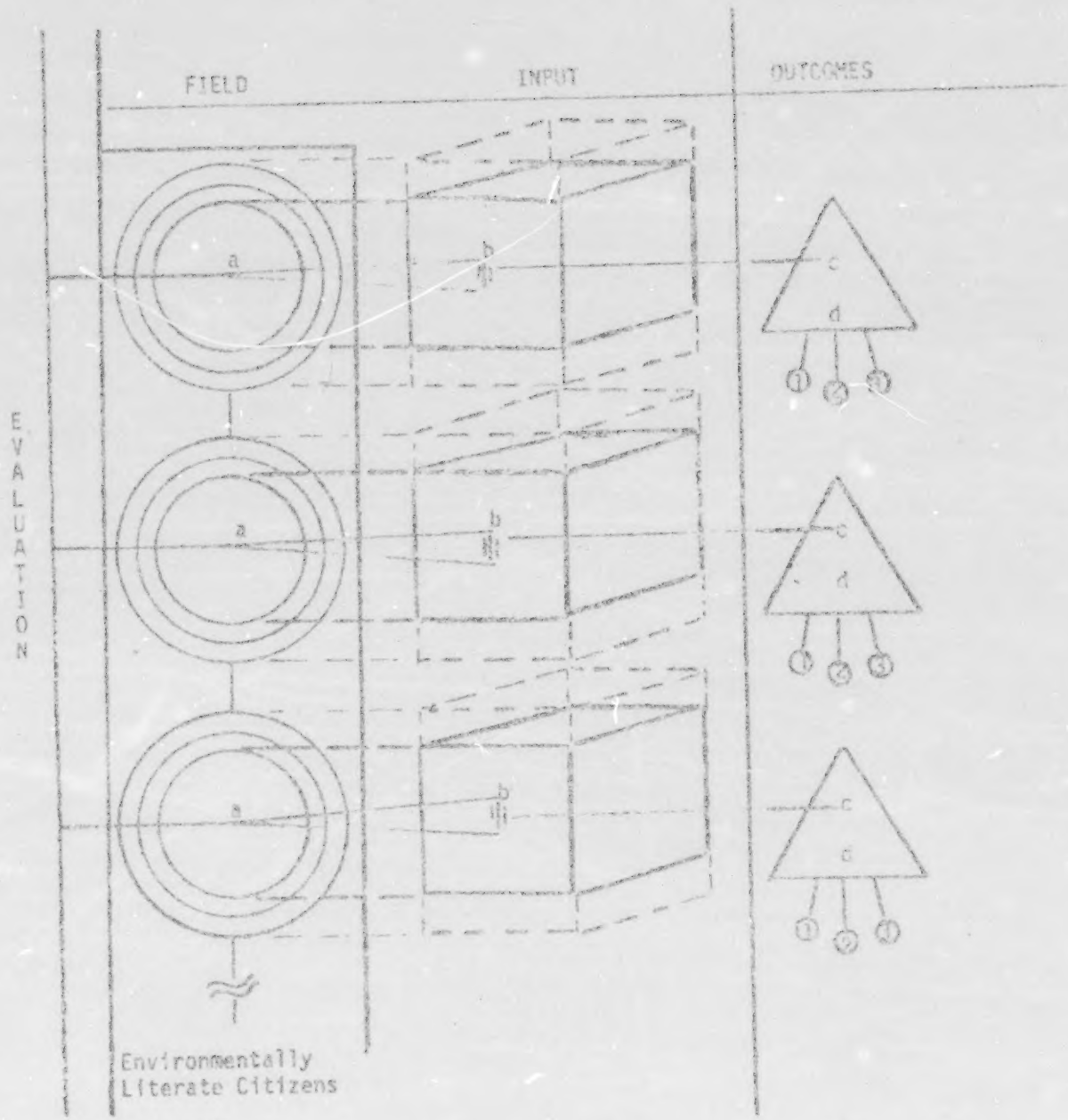
### Outcomes

After selection, materials will be sent to the teacher accompanied by corresponding assessment materials to measure outcomes. At appropriate times during and following teaching-learning activities (Diagram 4, section c), individual and group assessment (Diagram 4, section d) will take place. Based upon this assessment process, several alternative choices become available. These include:

1. re-cycling to meet basic objectives as needed;
2. judgment that objectives were accomplished, and a decision to choose another stage or another level of the same stage is made;
3. judgment that objectives were accomplished and a decision to stop is made.

The data generated by evaluation will be useful to the learner and teacher and will, as well, provide information on the success of the program materials. Such information will be helpful to and necessary for improvement of the parts of the program.

DIAGRAM 4



# APPENDIX A

## Brief Description of the

## MAINE ENVIRONMENTAL EDUCATION PROJECT

## Title III, E.S.E.A.

# MAINE ENVIRONMENTAL EDUCATION PROJECT

The Maine Environmental Education Project views environmental education as a process aimed at producing a citizenry that possesses a knowledge, motivation, and ability to maintain and improve the quality of the total environment for all life, and a process for improving the quality and effectiveness of educational practices at all levels in all disciplines. The project's two goals include (1) development of a wide geographic network of K-12 locally funded programs with trained coordinators; (2) an innovative teaching-learning process and related activities for classroom and firsthand community total environment studies; (3) a practical evaluation model for assessing student outcomes; (4) model organizational methods and implementation strategies for total community resources, and community people; (5) graduate, undergraduate, and inservice education programs and courses within the State University system and courses approved by the State Department of Educational and Cultural Services.

Grade level: K-12. Dean B. Bennett, Project Director; Intermediate School, Yarmouth, Maine 04096; Telephone: (207) 846-3392.

# APPENDIX B

Example

of a

UNIT OUTLINE

TWO-WEEK JUNIOR HIGH SCHOOL ENVIRONMENTAL EDUCATION UNIT

THE SCHOOL SITE ENVIRONMENT

PILOT UNIT TESTED AT FREEPORT, MAINE JUNIOR HIGH SCHOOL 1972

One 80 Minute Period Per Day

Developed by The Maine Environmental Education Project and
The Regional Environmental Education Program

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WEEK 1

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MONDAY:

UNIT PRETEST - Formal Pencil-and-Paper Test with slides

UNOBTRUSIVE - Citizen Questionnaire and School Site Survey

---

TUESDAY:

PHASE I: Discovery - Inquiry

A. Introduction to the Unit
   1. The need for environmental quality
   2. The roles of citizens

B. Presentation with slides
   1. Natural & man-made components of the environment
   2. Natural and human ecosystem concepts

C. Student development of chalkboard map of school site
   1. Map of shape and size of site
   2. Identification of natural and man-made features - location, shape, size, amount, characteristics

---

WEDNESDAY:

A. Student discussion and listing of important information to gather about components
   1. Kind
   2. Location
   3. Size - Shape
   4. Amount
   5. Characteristics

B. Demonstration of equipment and techniques for environmental investigation

C. Student selection of topics to investigate

D. Guidelines for compiling and mapping information

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THURSDAY: Student field investigation of natural and man-made environmental components

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FRIDAY: A. Student compilation of information, writing of reports, development of maps

PHASE II: Evaluation - Problem Identification

B. Presentation with slides

1. Criteria for evaluating the natural environment
2. Criteria for evaluating the man-made environment

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WEEK 2

---

MONDAY: A. Review of environmental evaluation concepts

B. Introduction to environmental evaluation assignment sheets

C. Student field environmental evaluation of the school site

D. Class discussion - identification of opportunities for environmental improvement

---

TUESDAY: A. Introduction to kinds of environmental problems

B. Student field identification and listing of problems for student involvement

PHASE III: Problem Solving

C. Introduction to the problem-solving process

WEDNESDAY:

A. Student selection of problems to help resolve

B. Student preparations for problem-solving

1. Description of the problem (why a problem, etc.)
2. Listing of alternative solutions
3. Selection of best solution - reasons, etc.
4. Planning for action
5. Listing of tools, equipment and supplies needed

THURSDAY:

A. Student field problem-solving activities

B. Review of projects

C. Review of unit phases

FRIDAY: UNIT POST-TEST (same as pretest)